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SIMULATION BASED ACQUISITION (SBA) IMPLEMENTATION STRATEGY

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Office of the Administrator			
Title: Simulation Based Acquisition Implementaiton Strategy (SBA)	Document No.:		Baseline
	Effective Date: 16 Feb 2005		Page ii of v

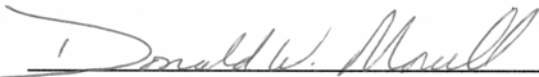
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Office of the Administrator		
Title: Simulation Based Acquisition Implementaiton Strategy (SBA)	Document No.:	Baseline
	Effective Date: 16 Feb 2005	Page iii of v

SIMULATION BASED ACQUISITION (SBA) IMPLEMENTATION STRATEGY

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Office of the Administrator		
Title: Simulation Based Acquisition Implementaiton Strategy (SBA)	Document No.:	Baseline
	Effective Date: 16 Feb 2005	Page iv of v

Table of Contents

1.0	INTRODUCTION	5
2.0	SIMULATION BASED ACQUISITION CONCEPT	5
3.0	SBA IMPLEMENTATION PRINCIPLES	7
4.0	RESPONSIBILITIES OF THE SBA SUPPORT OFFICE	9

Office of the Administrator		
Title: Simulation Based Acquisition Implementation Strategy (SBA)	Document No.: SA - 0001	Baseline
	Effective Date: 16 Feb 2005	Page 5 of 10

1.0 Introduction

This document presents our strategy for implementing simulation-based acquisition (SBA) for programs managed by the Exploration Systems Mission Directorate (ESMD). It addresses:

- The SBA Concept
- SBA Implementation Principles
- SBA Implementation Responsibilities

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Inquiries regarding SBA should be directed to Mr. Don Monell, Director, ESMD SBA Support Office (phone 202.358.1487; e-mail dmonell@hq.nasa.gov).

2.0 Simulation Based Acquisition Concept

2.1. SBA Goals

We are implementing SBA to make the realization of the Vision for Space Exploration more certain. SBA will empower our talented and dedicated people to execute improved processes enabled by new capabilities, most importantly early and ongoing Modeling and Simulation (M&S) of systems and their environments. Executed properly, SBA will foster better informed, timelier and more defensible decisions throughout the acquisition life cycle. By so doing, SBA will improve the quality of our systems and speed their development, at less cost and risk than would otherwise be the case.

2.2. SBA Scope

SBA is a comprehensive, enterprise wide endeavor that necessitates:

- An evolved culture (skills, roles, responsibilities, attitudes)
- A revised spiral acquisition process (M&S wherever it helps, broad trade space, broadly collaborative, tailorable)
- An SBA infrastructure of advanced IT capabilities (further discussion below)

SBA encompasses:

- The entire team (government, industry, others)
- All project phases, from requirements analysis and concept formulation, through design, manufacture, training, and operations

Office of the Administrator			
Title: Simulation Based Acquisition Implementation Strategy (SBA)	Document No.: SA - 0001		Baseline
	Effective Date: 16 Feb 2005		Page 6 of 10

- All professional disciplines and all activities that can benefit by employing SBA capabilities, to include:
 - Developing and assessing system concepts and designs
 - Planning manufacturing, assembly, transport and launch
 - Training crews, maintainers, launch personnel and controllers
 - Planning and monitoring missions
 - Responding to emergencies by evaluating effects and exploring solutions
 - Communicating across the enterprise, within the government, and with the general public

2.3. Functional Characteristics of the SBA Infrastructure

The SBA infrastructure provides the capabilities necessary to enable enterprise personnel to effectively do their jobs. Its functional characteristics include:

- All information needed for product development activities, including M&S-based design and assessment, is readily available from a user's desktop. This information is configuration managed, authoritative, coherent, and understandable.
- A robust tool kit of validated modeling and simulation capabilities is available in a timely manner to assist the professionals that must deal with the complexity of system acquisition. The tools assist in design (e.g., integrated architecture modeling, CAD, assembly planning), assessment (e.g., FEA, CFD, human factors, mission, cost), and management (e.g., workflow, risk assessment). These capabilities may be provided by individual models and simulations (operating separately or serially) or federations of simulations that operate together (executing in parallel). The simulations may be constructive (all software), virtual (human operators in simulated working environments), or live (humans and real system components operating in a simulated environment, in a lab or on a test range).
- Other supporting software applications provide a means to collaborate, weigh measures of merit, make decisions and record decision rationales.
- Efficient communication networks allow the rapid exchange of data among users, tools and data repositories.
- Security mechanisms, including user identification and encryption, provide access control and prevent information exploitation or corruption.

Office of the Administrator			
Title: Simulation Based Acquisition Implementation Strategy (SBA)	Document No.: SA - 0001		Baseline
	Effective Date: 16 Feb 2005		Page 7 of 10

- Adequate computational power and human interface devices (e.g., displays) support the above

2.4. Denials

SBA is not:

- A replacement for good systems engineering
- Having simulations make the decisions
- Giving all information to everyone
- Letting everyone see everything you do
- The loss of security and proprietary advantage
- The loss of responsibility, authority and/or accountability
- Just using M&S for its own sake

3.0 SBA Implementation Principles

As we implement SBA for ESMD projects, the following principles shall guide us:

- 3.1. Common sense.** Remembering that SBA is not an end in itself, all implementation actions shall focus on enabling the Vision for Space Exploration in the most prudent manner possible. Although a powerful tool, simulation will not be the optimal means to satisfy every requirement. ESMD will seek cost-effectiveness in all its actions, pursuing a practical course that makes sense from a business case standpoint.
- 3.2. Systems engineering approach.** To optimally acquire the complex systems necessary to realize the Vision for Space Exploration, SBA calls for establishing an acquisition environment of people, processes and information technology infrastructure that is itself a complex system. Disciplined systems engineering shall be applied to put this environment in place.
- 3.3. Teamwork.** All participants in the ESMD enterprise - government, industry, Federally Funded Research and Development Centers (FFRDCs), University Affiliated Research Centers (UARC)s, international partners and others – shall be regarded as a team and shall work as a team to implement SBA.
- 3.4. Central coordination, distributed execution.** We have established an SBA Support Office (SiBASO) to coordinate SBA implementation and realize the policies, processes and capabilities that should be

Office of the Administrator			
Title: Simulation Based Acquisition Implementation Strategy (SBA)	Document No.: SA - 0001		Baseline
	Effective Date: 16 Feb 2005		Page 8 of 10

consistent across the enterprise. This office will work with everyone involved in the ESMD enterprise to facilitate the realization of SBA. However, the SiBASO can not do it alone and the existence of this office does not relieve others from their responsibility to implement SBA. Almost every organization (e.g., the Systems Engineering office for each program, CIO, Acquisition Strategy/Business Management) will need to act to ensure SBA success.

- 3.5. Embedded, not standalone.** SBA must be embedded in everything we do, most importantly the acquisition strategy and systems engineering process. Program plans, such as the Systems Acquisition Management Plan (SAMP) and Systems Engineering Management Plan (SEMP), shall reflect SBA concepts and consider any necessary process or infrastructure changes.
- 3.6. Prioritization per program needs.** The most critical program issues, as identified by program leaders, shall be given highest priority for SBA support. Understanding, from a program perspective, the key questions that must be answered should be the first step in considering the use of modeling and simulation, for it drives what must be represented and this in turn determines the feasibility, cost, schedule and risk of the M&S effort (development, procurement or modification). M&S funds should be spent where they can do the greatest good for the least cost (Pareto's Principle: the 80/20 rule). This same principle applies to priorities for information management activities. As we seek to share trustworthy information across the enterprise, priority should be given to critical information and that which is widely needed.
- 3.7. Commonality where warranted.** Common M&S tools shall be used wherever multiple organizations have similar needs that can be satisfied with a common tool and a sound business case exists for providing such a tool. When these criteria are satisfied, a common tool shall take priority over multiple, uncommon tools. For needs unique to government organizations, their deployment and support will be the responsibility of the SBA Support Office. For common needs in industry, the selected contractor or, if one exists, the lead systems integrator (LSI), shall be responsible for achieving such efficiencies. The funding and management of other M&S tools, which will outnumber the common tools, will continue to be the responsibility of the organizations that employ them.
- 3.8. Openness.** To make more optimal decisions in the larger trade space and to ensure a coherent understanding of the system and its environments, ESMD team members will need to collaborate and share information beyond traditional organizational boundaries. They must also be willing to explain to others the context and rationale for a

Office of the Administrator			
Title: Simulation Based Acquisition Implementation Strategy (SBA)	Document No.: SA - 0001		Baseline
	Effective Date: 16 Feb 2005		Page 9 of 10

particular argument and to provide additional information (metadata) that may be necessary to allow others to understand, and use appropriately, information that is shared across organizations.

3.9. Evolving government and contractor responsibilities. The participants in SBA activities and responsibility for the SBA infrastructure will vary with the development spiral and program phase per the acquisition strategy chosen by the ESMD. In the early stages, particularly during competitive phases, the government will lead. Once a contract has been awarded, be it for a particular system or system integration, the lead will shift to that contractor, with the government maintaining insight, assessing progress, identifying issues and providing advice and direction to the contractor as appropriate within contract constraints. Government-unique responsibilities, such as model-based Requests for Proposals (RFPs), proposal evaluation, and independent assessments, will endure throughout the program.

3.10. Reuse. Reusable elements of the SBA infrastructure, such as information and M&S tools, should be provided by the organization that can do so most cost-effectively and be shared with other organizations to the extent allowable by licensing and security considerations. Contract provisions must accommodate this.

3.11. Security. Information security, to include the protection of proprietary, classified and ITAR-restricted information, shall be established. Office of Exploration Systems security policies will govern the techniques used.

3.12. Standards compliance. To reduce risk and facilitate interoperability and reuse, elements of the SBA infrastructure shall favor compliance with proven commercial standards (e.g., ANSI, IEEE, OMG).

3.13. Continuing assessment. Regular evaluations of SBA implementation progress and impacts shall be conducted, from both a government and industry perspective, in order to identify and resolve any issues that arise.

4.0 Responsibilities of the SBA Support Office

The ESMD Simulation Based Acquisition Support Office (SBASO) shall be responsible for accomplishment of the following tasks, which may be carried out by its government personnel or overseen by them.

4.1. Plan and coordinate SBA implementation across the enterprise.

4.2. Provide SBA orientation and training across the team as appropriate.

Office of the Administrator		
Title: Simulation Based Acquisition Implementation Strategy (SBA)	Document No.: SA - 0001	Baseline
	Effective Date: 16 Feb 2005	Page 10 of 10

- 4.3. **Advise other organizations** (whether government or not) about those actions they should take to ensure a successful implementation of SBA and **serve as a supporting asset** to them in the execution of these SBA responsibilities (e.g., provide inputs to key program documents such as the acquisition strategy, SEMP, and solicitations).
- 4.4. **Identify M&S needs** in ESMD programs **and help assess options** for satisfying them.
- 4.5. Identify the need for, select, develop or procure, deploy and support **common and/or critical M&S tools** across the government team. Facilitate contractor access to these tools.
- 4.6. Capture and share **M&S best practices**, to include modeling techniques, M&S tool procurement, M&S tool development, and M&S tool use.
- 4.7. Understand and prioritize the **information needs** of the M&S tools employed on ESMD programs.
- 4.8. In coordination with the ESMD CIO, manage development of the **information metamodel** necessary to effectively share system development information across the enterprise.
- 4.9. Assist the ESMD CIO in establishing the **web-based information services** necessary to allow team members to easily find, get, understand and use the information they need.
- 4.10. Provide **information provisioning oversight** across the enterprise.
- 4.11. Identify **verification, validation and accreditation (VV&A) policies and procedures** to assess the trustworthiness of modeling and simulation results, and monitor compliance with these procedures across the enterprise.
- 4.12. Execute such **other central SBA implementation actions** that the government may need to ensure SBA coherence and cost-effectiveness.
- 4.13. **Assess SBA implementation progress and impacts** across ESMD programs and advise the Associate Administrator and others accordingly. Towards that end, the SBASO may establish metrics and prudently require the reporting of same by enterprise organizations.
- 4.14. **Resolve emergent SBA issues** and/or bring them to the attention of the responsible authority.